The Electrical Value of Wind Power.

The electrical utilization of wind power has obtained considerable popularity in Europe, and for several years now the Danish government has been conducting a series of experiments with windmills, to ascertain the relative amount of electrical power that can be generated thereby. In this country similar experimental tests have been tried, and although the instances are not numerous and are somewhat isolated, the data furnished indicate a useful future for this form of prime mover. This is particularly true of the agricultural regions of the West, where innumerable windmills have been constructed in the last ten years for irrigating purposes. The question of harnessing these windmills to motors for the generation of electric light, and even power, is likely to receive the attention of the farmers within the next few years.

Probably one of the first experimental efforts made to utilize wind power for generating electricity was that of Dr. Charles F. Brush, inventor and pioneer in electrical experiments, who installed a windmill plant at his home in Cleveland in 1889, to light his house and laboratory. This windmill generating station is in use to-day, and during its sixteen years of operation, has furnished an excellent example of what may be expected of windmill motors in that section of the country. The fact that the wind power and variation differ considerably in the several States should be taken into consideration, and the value of this form of prime mover may prove more profitable in one section than another. The constant or average wind velocity for the year must be considered, rather than for a month or season.

The simplicity of the windmill generating plant is one of its cheif features. In Dr. Brush's plant the dynamo is connected by pulleys, so that fifty revolutions are made to every one of the windmill, and the normal speed of the former is 500 revolutions a minute. In an ordinary wind with a velocity of 8 miles an hour this windmill works the dynamo to its normal speed, developing a load of 12,000 watts. Unfortunately, however, a wind velocity of 8 miles an hour cannot be depended upon steadily in the vicinity of Cleveland, and a storage battery is necessary for equitable operation. The average wind velocity for the United States is given at 8 miles an hour, but in many part of the country a velocity of only 4 and 5 miles is maintained throughout the summer. The dynamo of the Cleveland plant is arranged to be automatically put into operation at 330 revolutions per minute. The working circuit opens automatically at 70 volts and closes at 75 volts In the basement of the house twelve batteries of 34 cells each are installed, and these are charged and discharged in parallel. With each having a capacity of 100 ampere-hours, it is possible to light 100 16-candle-power incandescent lamps. The successful working of this plant for lighting the house and laboratory has demonstrated the value of a windmill generating set for light loads.

The question of the general construction of the windmill itself has been the subject of considerable experiment. In this respect the Danish experts reached the conclusion that a curved wing would develop nearly twice as much power as the plane wing. This is better stated thus in figures: While the maximum power obtained from a curved wing was 108 gramme-meters per second per square meter of surface, the power obtained from a plane wing was only 42 gramme-meters. Grooved wings gave power equal to curved wings, and this form of windmill wing has been used ever since in all of the Danish tests. Four wings make the most convenient form of windmill in use, and constant proportion between the length and width of the wings gives the highest results. Thus, to secure the most satisfactory surface area, the width of each wing should be from one-fourth to one-fifth the length, and the greatest width should be about three times as great as the narrowest part. The greatest width of the wing is placed in front, so that wind is caught and carried toward the center, where it finds ready space for its escape. In such a windmill the tip of the wing should develop a speed 2:43 times that of the wind when working. The windmill plant Wittkeil, in Schleswig, has demonstrated certain facts that carry out the foregoing statements. In this case the windmill has an enormous windmill is about 40 feet, and an effective wing space of nearly 1,000 square feet is presented to the wing The windmill develops 30 horse-power with a normal speed of eleven revolutions per minute. It operates a shunt dynamo that makes 700 revolutions per minute, and develops 160 volts and 120 amperes. This full load is developed when the wind is blowing at the rate of about 8 miles per hour. The windmill furnishes electricity to light the town of Wittkeil, and small motor's and lamps are connected to the storage battery, which maintains a voltage of 110. The battery has a capacity of 66,000 watt-hours. This plant has proved so satisfactory that it is being enlarged, and as a permanent lighting station it is likely to prove of unusual importance in the development of modern electricity by windmills.

In the adaptation of the windmill generating plant to commercial purposes in the country, experiments have taken some peculiar forms. In order to eliminate the storage battery, the windmill must be able to store up its energy in some other way. A number of methods to do this have been suggestsd. At present the extra cost of constructing the storage battery makes the initial cost of the plant more expensive than the first cost of an oil or steam-driven plant. After the first installation the cost of operation is very little, and if it were not for the constant oversight required of the storage battery, the plant would work entirely without any watchman. The storage battery requires the attention more or less of an electrical expert, and the labor question enters into the problem of operation. By eliminating the storage battery, the cost of installation, the repair items, renewals, and the labor item would all be reduced. One patent tested in this country was to utilize a compressed-air plant in connection with the windmill. The dynamo is direct-connected to the air compressor, and the power thus stored up could then be utilized as needed. But in this case the extra amount of mechanism increases the cost of installation even more than the storage battery. The compressor, more over, requires pretty constant watching, and the windmill generator thus approaches no nearer the self-regulating and operating machine than before.

Another method has been employed, which appears to contain some possibilities for the Western farmers, where windmills are already in use for pumping water for irrigating purposes. By means of storage tanks, the windmill pumps the water to a loped by the falling water is utilized for driving a water turbine or wheel. In this case the dynamo is driven very much like any hydraulic generating plant, and ordinary motors and generating sets could be adapted to the work. The turbo-generating method of utilizing the windmill for electrical development would require nearly as much expense for initial installation as any of the other methods, but once in working order it would prove purely automatic and self-regulating. The great size of the tank required to develop sufficient horse-power to operate the generators is one of the drawbacks to this system. The loss of efficiency would be considerable, and the ordinary windmill now in use for electrical generation would have to be increased in size or supplemented by several others. Such a storage tank would, moreover, have to be large enough to hold sufficient water to run the turbo-generators for at least eight or ten hours consecutively. Even then the plant might be put out of work for ten hours or more through the failure of the wind. All would depend upon the average velocity of the wind in the region where the plant was installed. The storage of water by means of windmills in reservoirs on the hillsides has been suggested, thus furnishing artificial supply of water for hydraulic purposes. In this case a sufficient number of windmills might be installed to pump the water in a huge reservoir that would never be exhausted. The results of such an experiment would certainly prove of interest to engineers, but it is somewhat doubtful if the returns would pay for the heavy outlay of funds for the windmills and the storage reservoir. Yet despite these many serious drawbacks to windmill electrical engineering, it is quite apparent that in the course of time the power of the wind will be used more and more for developing electricity, and with new mechanical methods better results are bound to follow.—Scientific American.

The Suez Canal Explosion.

Details have come to hand of the methods adopted when the steamship "Chatham," which recently sank in the Suez Canal with a load of dynamite on board, was removed by blowing up the vessel. Some curiosity has been expressed as to the way in which the detonation of this large at once certain and safe, and we are indebted to an Egyptain paper published on the day after the removal of the wreck, for an accurate description of the greatest explosion of dynamite on record. The steamship "Chatham," when it took fire and was scuttled in the Suez Canal, had on board about 100 tons of dynamite, as well as a supply of detonators. The blowing up of the ship was accomplished by means of large mines, each containing 300 pounds of explosive and fitted with the proper electric fuses. One of the mines was placed by divers in the hold in which the cases of dynamite had been loaded, and the other mine was lowered into the hold containing the detonators. Cables were led from the mines to the shore, where they were connected to two of the telephone wires on the banks of the canal. The firing station was located three miles from the sunken wreck, and after the circuits had been tested by sending a small current through electric resistance fuses, the mines were fired. An enormous colum of water and debris immediately arose, and ascended continuously for five seconds, the estimated height of the column being over 1,500 feet. The report of the explosion reached the firing point in sixteen seconds after the firing key had been depressed, and it was noted that the report was not particularly loud. The earth tremor, however, was felt almost instantaneously, in fact, while the firing key was still depressed. Although half a minute after the explosion the greater part of the debris had fallen, the air continued for over two minutes to be obscured with what looked like a mist. Although telephone wires were torn from the posts opposite the explosion, the blast was not sufficient to throw down the posts themselves. The water of the canal overflowed the surrounding country for a thousand yards in every direction, and fragments of the ship were distributed over a circle 1,200 yards in diameter. The enormous downward thrust of the explosion was shown when soundings came to be taken over the spot where the ship had lain. Here was found a huge hole, 73 feet in depth. This is the greatest explosion of dynamite over recorded, the nearest approach to it being the blowing up of Hell Gate in 1876, when 50 tons of high explosive was detonated, and the accidental explosion some years ago of 30 tons of dynamite at the port of Lisbon.—Scientific